THE NEWS LETTER
OF THE
BUREAU OF PUBLIC ROADS

VOL. 2, NO. 8 JUNE, 1927 A. C. ROSE, EDITOR

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COMPOSITE CONCRETE AND WOODEN PILING A UNIQUE FEATURE OF OREGON FEDERAL-AID BRIDGE

COMPILED FROM REPORTS SUBMITTED BY R. E. MERRICK OF DISTRICT 1 AND C. B. MCCULLOUGH, BRIDGE ENGINEER OF THE OREGON STATE HIGHWAY DEPARTMENT

COMPOSITE CONCRETE AND WOODEN PILING WAS A UNIQUE FEATURE IN THE CONSTRUCTION OF THE TRESTLE SECTION OF THE FEDERAL-AID BRIDGE ON UNITED STATES ROUTE 101, ACROSS THE SILETZ RIVER, NEAR TAFT, OREGON. THE STRUCTURE (F.A. PROJECT NO. 110-D) CONSISTS OF A 240-FOOT STEEL SWING-SPAN OVER THE MAIN CHANNEL, A SHORT APPROACH ON THE NORTH END, AND 414 FEET OF TRESTLE, WHICH CONNECTS THE SOUTH EXTREMITY WITH A 10-FOOT FILL EXTENDING FOR A DISTANCE OF HALF A MILE ACROSS AN OPEN TIDE-FLAT. (FIGURE 1 - TOP)

THE PLANS AND SPECIFICATIONS FOR THE APPROACH TRESTLE CALLED FOR THREE COMPOSITE PILES TO EACH BENT. THESE COMPOSITE PILES WERE TO BE CONSTRUCTED BY FIRST DRIVING A TIMBER PILE, AND FOLLOWING IT WITH A SECTION OF CONCRETE PILING, DRIVEN TO SUCH A DEPTH THAT THE ENTIRE TIMBER SECTION WAS SUBMERGED BENEATH THE LOW-WATER LINE. THE OBJECT OF THE CONCRETE-FOLLOWER SECTION WAS: (1) TO RESIST THE ATTACK OF THE TEREDO, WHICH BORES INTO WOODEN PILING IN THE ZONE BETWEEN THE GROUND OR FRESH-WATER LINE AND THE HIGH-TIDE LEVEL; AND (2) TO OVERCOME THE EFFECT OF ALTERNATE WETTING AND DRYING, CAUSED BY THE RISE AND FALL OF THE TIDE. SALT WATER IS THE NATURAL HABITAT FOR THIS WOOD-BORING MUSSEL, WHICH CAN NOT EXIST IN FRESH WATER. ABOVE THE HEIGHT SUBJECT TO THE RAVAGES OF THE TEREDO AND THE OXIDATION OF THE AIR, THE CHEAPER WOODEN TYPE OF CONSTRUCTION WAS USED. THE PLANS AT THIS LEVEL CALLED FOR A DECK OF WOODEN STRINGERS AND A PLANK FLOOR, ALL LAID UPON CONCRETE CAPS CAST UPON THE TOPS OF THE COMPOSITE PILING.

THE PRE-CAST CONCRETE PILES WERE DESIGNED WITH A TAPERED SHANK. (FIGURE 1 - BOTTOM) THE LOWER END OF THE PILE WAS ENLARGED TO FORM A BELL-SHAPED SECTION, IN WHICH WAS CONSTRUCTED A SOCKET 42 INCHES DEEP BY 14 INCHES IN DIAMETER, WHICH WAS FITTED OVER THE TOP OF THE PREVIOUSLY-DRIVEN TIMBER PILE. INTO THE OUTER END OF THE SOCKET WAS FIXED A CAST-STEEL DIE WITH A CUTTING EDGE. (FIGURE 2) PREPARATORY TO DRIVING THE CONCRETE PILE, THE TOP OF THE WOODEN PILE WAS TRIMMED SO AS TO BE ABOUT 1 INCH LARGER IN DIAMETER THAN THE DIE. AS THE DRIVING PROGRESSED, THE DIE CUT AWAY THE SURPLUS WOOD, AND A TIGHT FIT WAS OBTAINED BETWEEN THE WOOD AND CONCRETE SECTIONS OF THE COMPOSITE PILE.

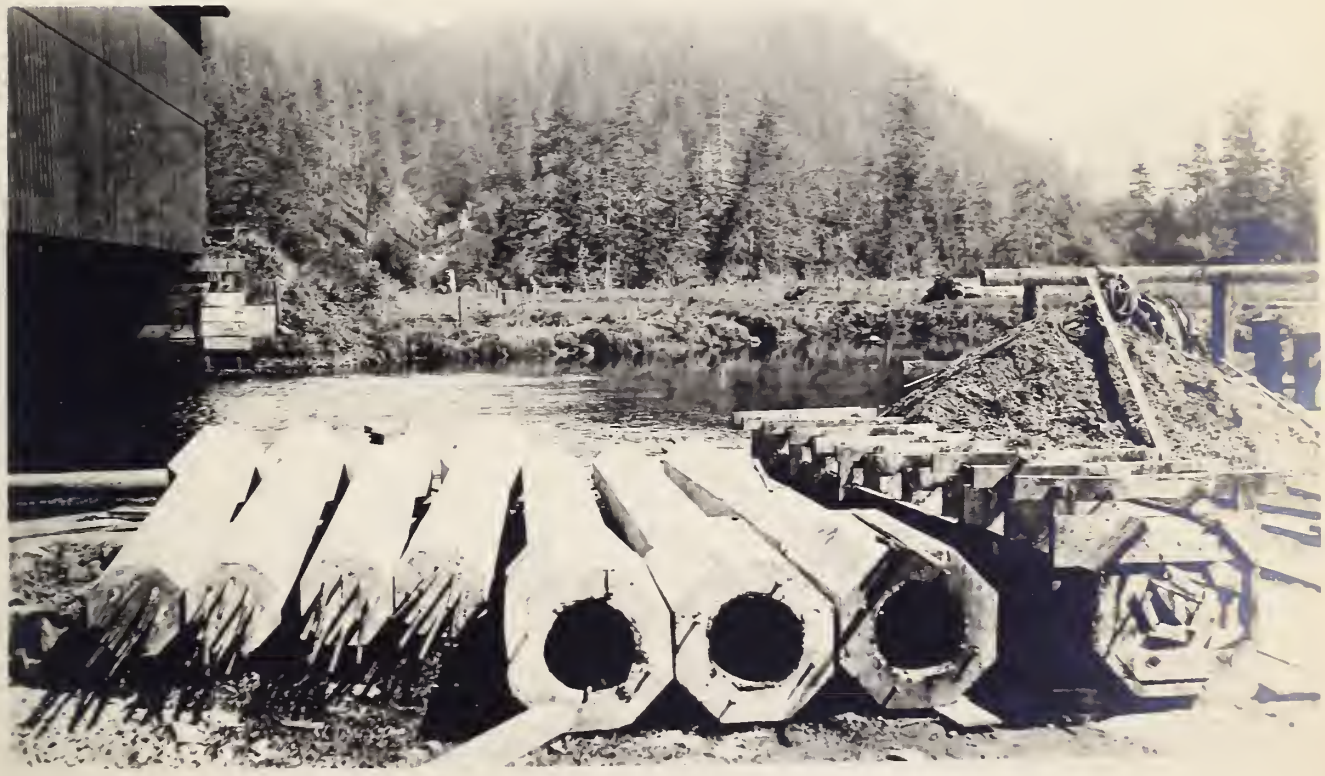


FIG. 1 (TOP). - GENERAL VIEW OF COMPOSITE-PILING TRESTLE ON OREGON FEDERAL-AID BRIDGE PROJECT 110-D

(BOTTOM). - UPPER AND LOWER ENDS OF COMPOSITE PILING

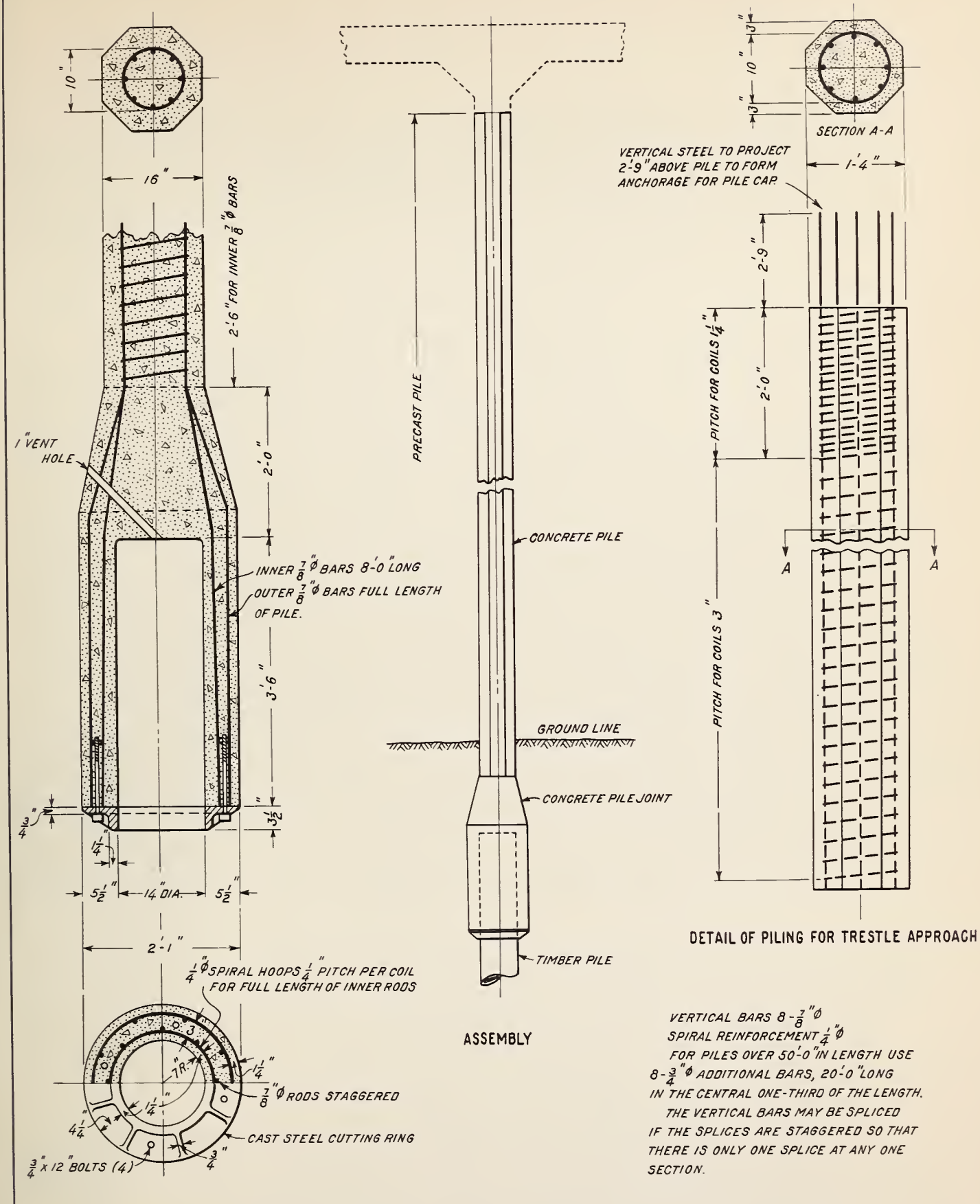


FIGURE 2 - DETAILS OF REINFORCED CONCRETE SECTION OF COMPOSITE PILING.

The concrete piles varied in length from 22 to 56 feet. On account of the proposed exposure to sea water, they were cured for more than the 60 days required by the specifications. The concrete in the piles developed a high strength - 1,839 pounds at the end of 7 days.

Method of Construction

The first step in the construction of the trestle was the driving of a series of test piles, to determine the character of the foundation. These were driven to a depth of 100 feet without reaching a solid footing through the silt, and sand and gravel deposit at the site of the bridge. After one or two days had elapsed, it was discovered that the test piles could be driven further with only a few blows of the hammer. This condition influenced the contractor to drive the timber piles, for the entire approach, several weeks in advance of the time when the concrete sections had become finally cured. This was intended to give the wooden stubs ample time to reach a condition of equilibrium with the surrounding soil. These wooden units, from 45 to 50 feet in length, were driven so that 6 or 8 feet projected above the surface of the ground. More than 60 days later, when the concrete sections were spliced to the wooden piles, it was discovered that the latter were held so tightly by the surrounding soil, that it was impracticable to drive them without resort to auxiliary equipment. It was even difficult, in some instances, to start the wooden stubs after jetting four holes around each one. It is believed that the difficulties and cost of construction could have been reduced considerably, if the timber stubs and concrete followers had been driven in one continuous operation.

The driver was constructed with a pendulum lead so that, when once set in position on a bent along the center line of the roadway, all the piles in the bent could be driven without changing its location. This method made it necessary to alter the batter of the piles as shown on the plans, so that their projected center lines would intersect at a common point - coinciding with the head-block of the driver. The contractor used a 7 x 10 American Hoist donkey-engine, which was slightly overloaded by the concrete piles, the maximum length of which was 56 feet. He recommends an 8-1/4 x 10 donkey-engine with a separate heavy head-block, and with the running line for handling the pile set not less than one foot in front of the main head-block for the hammer.

Developments During the Driving Operations

The first attempts at driving the concrete-pile sections were not very successful. A No. 1 Union steam hammer was tried first with unsatisfactory results. A 4,600-pound drop hammer was then resorted to with considerable increase in driving efficiency. For short piles, it is probable that the steam hammer would have proved superior, but the mass of the long composite piles was so large in proportion to the energy developed by the steam hammer, that satisfactory penetration could not be attained. A cast steel mushroom-shaped follower was interposed between the hammer and the pile head. The follower was recessed beneath to allow for the insertion of a cushion, consisting of two layers of 2-inch spruce separated by one inch of rubber. Holes were drilled in the flange of the follower to permit the passage of the reinforcing bars, which projected from the top of the pile.

The driving of the concrete sections was begun at the south end on a vertical pile. About twenty feet of penetration was obtained, and it was necessary to trim the badly-shattered top of the concrete pile. The next trial was made on one of the battered units which, after being driven about 15 feet, broke in the center, and the upper portion had to be withdrawn. The break was caused by lack of support at the mid-section. Following this experience, lateral timber braces were placed near the center of the pile, and no further difficulty of this kind was encountered. These braces prevented any undue kicking of the pile, especially of those on a batter.

In one instance a concrete pile was broken, during the driving, a short distance below the ground line. This was caused by excessive driving, after the point of the pile had penetrated a deep layer of intermingled logs and stumps. The break, which occurred about four feet above the bell-shaped socket, was of the typical conical, compression-failure type. The reinforcing steel was bent inward on all sides. Repairs were made by sinking a crib, and excavating the earth around the pile to permit the construction of an 18-inch reinforced concrete collar, from the bell to a point four feet above the top of the break. This experience indicates that, when hard driving is anticipated, it would be desirable to reduce the diameter of the bell-shaped pile-end. This could be accomplished by reducing the diameter of the top of the wooden pile, by cutting a shoulder around the complete circumference; and also by reducing the thickness of the walls of the socket, and adding more reinforcement. It would also be well to place a steel driving-ring four or five inches wide, around the top of the concrete pile.

The contractor states that the steel castings, used for the sockets in the bell-shaped ends, were excessive in cross section and weight. In his opinion a one-inch thickness would have been sufficient, and would have reduced the cost materially. As it was, the castings, which cost $18 apiece, were effective as a die for cutting the head of the wooden pile to the proper size. Whether this would be the case if the dimensions of the bell-shaped socket were reduced must be determined by further experiment. The 45-degree bevel on the cutting edge also resisted any sidewise movement and consequent splitting of oblique-grained piles, which might have occurred had the angle been flatter.

After the piles in the first bent were placed, the balance of the driving was less difficult. The greater difficulty, experienced in driving the initial piling, was probably caused by the weight of ten feet of new sand-fill under the bent, which may have compressed the subsoil. An effort to start the stub pile by direct driving was unsuccessful. Thereafter, four holes were jetted around each stub pile before driving was begun, and two jets were operated continuously while the concrete followers were being driven, except for the last few feet of penetration, when the jets were withdrawn. A crew of eight men drove an average of 2-1/2 and a maximum of 5 piles in one day.

The concrete piles were driven so that the bells, in the bents on the bank, were at least 6 feet below the low-water level. In the stream, where the water was more than 6 feet deep, the bells were driven in all cases below the ground line, thus giving added strength to the bents. The tops of the completely-driven concrete piles were considerably out of line, on account of the deflection caused by the heterogeneous nature of the foundation material. All variations in alignment were compensated by altering the dimensions of the concrete cap.

The erection of the steel span presented no unusual difficulties. It was fabricated on the rest pier in a direction parallel to the center line of the stream. A small framed bascule bridge, operated by a winch, permitted the construction crew to cross the channel on the north end. This temporary bascule bridge was raised, as occasion required, to provide a clear passageway for boats. Except for some painting and miscellaneous work, the structure was finished by December, 1926.

Advantages of Composite Piling

The principal advantage of the composite piling is the relative ease in handling. Where monolithic concrete piling is used, especially where the piles are of great length, there is considerable difficulty in handling them in the leads. In the Siletz River work, the use of monolithic piling would have necessitated a reconstruction of the equipment to obtain the proper batter. By utilizing a composite type, the relatively short timber stubs could be driven first and then followed by the concrete units. This made it unnecessary to handle the entire length of the pile at one operation.

Another advantage of the composite pile is the reduction in first cost. Concrete piling costs from 4 to 6 times as much per lineal foot as timber piling. Where the length involved is great enough to offset the additional cost of the socket joint, a considerable saving is made possible by the timber section.

The type of piling used on this project appears to be entirely practicable, and may be used wherever ordinary concrete or timber piling can be driven.

Disadvantages of Composite Piling

The principal disadvantages of the composite piling may be attributed to the jetting difficulties, the additional cost of the socket joint, and the amount of driving energy absorbed by the socket joint.

It is more difficult to jet a composite pile than either a concrete or timber pile alone, because of the presence of the bell-shaped joint. The widened section holds the jet at a distance from the side of the pile at the normal section, and makes it difficult to direct the stream of water under the toe, where it is most effective. One of the most efficient types of concrete pile contains, in the center, a pre-cast jetting pipe. It is obvious that this construction could not be used in a composite pile.

Apparently, the presence of so many joints, between the hammer and the tip of the pile, causes a loss of driving energy, which the steam hammer does not overcome.

General Observations

In general, it may be said that there is no difficulty inherent in the curing of the composite pile which does not apply to all concrete piling. With regard to handling, the concrete stubs were as easy to manipulate as concrete piling of the same length and weight. The seating of the concrete sections on the wooden stubs was, comparatively, a simple operation. In fact, toward the end of the job, it was found to be unnecessary to shape the top of the wooden stub; because the cutting edge of the socket shaped the timber to size without splitting or damage of any kind.

On this project, the reinforcing steel was carried above the top of the concrete pile to provide a suitable connection with the concrete caps. This made necessary a rather complicated follower-block to fit around the steel. The experience gained on this project indicates that it would be better practice to cast the concrete above the ends of the steel, with the intent of chipping the concrete after the driving is completed to expose sufficient steel for a proper joint. The jar of the follower-block causes the concrete to spall, in any event, and makes necessary considerable cutting and trimming. For this reason, it is believed that the additional expense, caused by the elimination of the follower-block, would be more than compensated by the savings in driving time.

All in all, the results obtained by the use of the composite piling were entirely satisfactory. The contractor probably lost money on the pile driving, and if so, a considerable portion of this loss may be attributed to the novelty of the method, and to the lost motion in getting properly equipped for the work. In the light of the final penetrations, it is possible that the piles were driven 4 or 5 feet deeper than was necessary. Although the results were satisfactory, the costs of driving the last few feet were excessive. Another factor, which prevented low driving costs, was the practice of driving the stubs some weeks prior to the concrete followers. This caused the stubs to set solidly, and resist further penetration. The primary reason for this procedure, however, was to avoid delaying the driver-crew while the timber piles were being cut off, and shaped to receive the bell-shaped socket. A further loss of time was experienced, because of the failure to cast the concrete followers in time to allow for their curing before the wooden stubs were driven. All of these delays, which increased the driving costs, could be eliminated in future work.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

M-4 (1926)
R. S. A.

STATE HIGHWAY SYSTEMS (1)

EXISTING MILEAGE AT END OF YEAR 1926.

STATES	1926 YEAR ENDS	GRAND TOTAL MILEAGE, STATE HIGHWAY SYSTEM	EARTH ROADS, NON-SURFACED			SURFACED ROADS BY TYPES												STATES
			TOTAL NON-SURFACED MILEAGE	UNIMPROVED, AND PARTLY GRADED	IMPROVED, TO ESTAB. GRADE AND DRAINED	TOTAL SURFACED MILEAGE	SAND-CLAY AND TOP-SOIL	GRAVEL, CHERT, SHALE ETC. (TREATED & UNTREATED)	WATERBOUND MACADAM (TREATED & UNTREATED)	BITUMINOUS MACADAM BY PENETRATION	SHEET ASPHALT	BITUMINOUS CONCRETE	PORTLAND CEMENT CONCRETE	BLOCK PAVEMENTS: VITRIFIED BRICK	BLOCK PAVEMENTS: ASPHALT	BLOCK PAVEMENTS: WOOD	BLOCK PAVEMENTS: STONE	
ALABAMA	9/30	3,936.3	1,763.8	1,733.2	30.6	2,172.5	507.8	1,285.6	40.8	44.7	5.7	93.9	93.8	-	-	0.2	-	ALABAMA
ARIZONA	12/31	2,031.4	609.9	332.3	277.5	1,421.5	-	1,221.6	-	9.5	15.0	39.7	135.7	-	-	-	-	ARIZONA
ARKANSAS	12/31	8,346.0	4,193.0	3,037.0	1,156.0	4,153.0	-	3,342.0	144.0	156.0	32.0	271.0	208.0	-	-	-	-	ARKANSAS
CALIFORNIA	12/31	6,582.1	3,044.2	2,511.7	(2) 532.5	3,537.9	-	(2)1,015.0	(2) 61.0	330.6	-	415.6	1,715.7	-	-	-	-	CALIFORNIA
COLORADO	12/31	8,955.8	5,467.3	4,748.1	719.2	3,499.3	5.9	3,240.6	-	-	-	5.9	245.9	-	-	-	-	COLORADO
CONNECTICUT	6/30	1,952.1	132.8	-	132.8	1,819.3	-	387.3	754.6	229.4	-	140.7	305.6	1.7	-	-	-	CONNECTICUT
DELAWARE	12/31	590.5	-	-	-	590.5	-	23.0	1.3	18.1	5.8	3.3	532.8	8.4	-	-	-	DELAWARE
FLORIDA	12/31	5,554.0	2,928.7	2,878.5	50.2	2,725.3	850.0	8.3	927.3	178.9	199.0	33.9	147.9	322.0	58.0	-	-	FLORIDA
GEORGIA	12/31	6,258.8	3,594.3	3,440.4	153.9	2,664.5	1,597.8	558.3	43.9	146.0	46.8	9.2	251.9	0.6	-	-	-	GEORGIA
IDAHO	12/31	4,558.4	2,220.8	1,845.6	385.2	2,437.6	79.9	1,796.7	404.0	-	5.4	104.8	46.8	-	-	-	-	IDAHO
ILLINOIS	12/31	(3) 9,459.6	4,964.1	4,585.0	278.1	4,495.5	-	-	0.5	5.7	4.6	8.7	4,399.7	76.3	-	-	-	ILLINOIS
INDIANA	12/31	4,262.6	107.3	-	107.3	4,155.3	-	1,601.0	1,163.6	200.6	-	25.3	1,094.2	69.3	-	1.3	-	INDIANA
IOWA	12/31	6,653.7	3,184.1	1,451.8	1,732.3	3,469.6	-	2,819.4	-	-	-	-	615.9	33.3	-	-	-	IOWA
KANSAS	12/31	7,887.0	6,548.5	4,984.7	1,563.8	1,338.5	335.0	239.1	-	104.9	-	3.0	507.5	148.0	-	-	-	KANSAS
KENTUCKY	6/30	(4) 9,545.5	5,454.5	4,872.1	582.4	4,192.1	-	1,508.2	2,230.3	240.9	-	13.8	173.3	25.6	-	-	-	KENTUCKY
LOUISIANA	12/31	(5) 8,000.0	3,292.8	3,292.8	-	4,707.2	-	4,630.3	-	-	20.2	0.5	25.7	15.5	15.0	-	-	LOUISIANA
MAINE	12/31	1,574.8	268.7	268.7	-	1,306.1	4.3	1,001.3	7.5	220.2	-	-	72.8	-	-	-	-	MAINE
MARYLAND	9/30	2,419.8	-	-	-	2,419.8	-	358.6	1,087.8	-	38.3	36.5	897.3	1.3	-	-	-	MARYLAND
MASSACHUSETTS	11/30	1,563.7	12.8	-	12.8	1,550.9	-	112.3	315.8	687.2	-	202.7	230.2	0.8	-	0.1	1.8	MASSACHUSETTS
MICHIGAN	12/31	6,756.8	527.5	527.5	-	6,229.3	-	3,632.6	638.7	77.1	-	203.4	1,671.0	6.5	-	-	-	MICHIGAN
MINNESOTA	12/31	6,930.9	577.4	66.8	510.6	6,353.5	107.5	5,390.0	14.8	8.0	-	72.7	735.2	13.0	-	12.3	-	MINNESOTA
MISSISSIPPI	12/31	(6) 6,721.0	2,882.0	2,490.4	391.6	3,839.0	5.4	3,575.2	10.7	4.9	7.0	13.9	202.7	19.2	-	-	-	MISSISSIPPI
MISSOURI	12/31	7,540.0	4,264.2	2,239.0	2,025.2	3,375.8	-	1,824.1	-	94.4	-	-	1,440.4	13.9	-	-	-	MISSOURI
MONTANA	12/31	7,957.2	7,030.3	6,754.8	275.5	926.9	-	884.9	0.6	5.5	-	3.8	32.1	-	-	-	-	MONTANA
NEBRASKA	12/31	6,256.0	3,491.9	2,811.8	680.1	2,754.1	443.6	2,216.7	-	-	3.1	10.1	71.1	19.5	-	-	-	NEBRASKA
NEVADA	12/31	2,995.0	1,973.4	1,758.3	205.1	1,022.5	10.0	943.1	-	20.6	-	2.0	46.9	-	-	-	-	NEVADA
NEW HAMPSHIRE	12/31	2,256.6	293.2	195.1	98.1	1,963.4	-	1,625.1	111.1	142.0	-	89.9	15.3	-	-	-	-	NEW HAMPSHIRE
NEW JERSEY	12/31	1,457.8	160.9	25.7	135.2	1,296.9	-	267.2	101.6	38.0	58.4	234.2	550.1	3.7	2.7	6.3	34.7	NEW JERSEY
NEW MEXICO	12/31	9,214.4	7,529.5	6,951.1	578.5	1,684.8	-	1,510.9	-	-	-	0.7	73.2	-	-	-	-	NEW MEXICO
NEW YORK	12/31	14,068.0	4,214.2	4,193.7	20.5	9,853.8	-	127.8	2,194.3	3,985.1	-	255.3	3,009.3	257.0	19.8	0.5	3.7	NEW YORK
NORTH CAROLINA	12/31	(7) 6,213.0	754.0	-	754.0	5,484.0	1,725.9	890.6	145.8	367.2	65.3	757.0	1,455.5	44.9	-	10.9	-	NORTH CAROLINA
NORTH DAKOTA	12/31	6,837.8	5,502.4	4,084.6	1,417.8	1,335.4	-	1,325.8	-	-	1.2	-	8.4	-	-	-	-	NORTH DAKOTA
OHIO	12/31	11,000.0	1,409.0	1,008.0	401.0	9,591.0	-	3,177.8	1,859.5	1,508.1	43.1	166.9	1,548.0	1,487.6	-	-	-	OHIO
OKLAHOMA	12/31	5,589.0	4,004.5	3,778.5	226.0	1,584.5	-	918.0	-	-	-	73.0	557.0	36.5	-	-	-	OKLAHOMA
OREGON	12/31	4,468.6	1,248.2	947.6	300.6	3,220.4	-	2,323.3	-	-	-	588.5	208.6	-	-	-	-	OREGON
PENNSYLVANIA	12/31	12,033.4	3,593.8	-	3,593.8	8,439.6	-	511.3	3,021.3	396.1	200.0	294.2	3,636.0	368.3	7.3	2.3	2.8	PENNSYLVANIA
RHODE ISLAND	12/31	821.7	370.2	370.2	-	451.5	-	22.5	117.3	115.9	7.2	127.9	60.7	-	-	-	-	RHODE ISLAND
SOUTH CAROLINA	12/31	(8) 5,143.3	1,273.4	1,198.9	74.5	3,869.9	(8) 3,070.0	430.0	27.3	11.2	75.0	87.2	159.2	-	-	-	-	SOUTH CAROLINA
SOUTH DAKOTA	12/31	5,923.5	3,455.7	1,253.5	2,202.2	2,467.8	20.4	2,444.2	-	-	-	-	3.2	-	-	-	-	SOUTH DAKOTA
TENNESSEE	12/31	5,051.0	1,495.5	1,211.6	283.9	3,555.5	-	1,565.2	1,051.1	547.7	35.0	74.8	281.7	-	-	-	-	TENNESSEE
TEXAS	12/31	16,726.0	9,471.7	8,092.5	1,379.2	9,256.3	424.2	5,540.1	745.1	1,787.5	17.1	47.5	612.6	82.2	-	-	-	TEXAS
UTAH	12/31	3,248.7	2,058.9	725.9	1,333.0	1,189.8	-	934.3	-	-	11.3	42.7	201.5	-	-	-	-	UTAH
VERMONT	12/31	4,462.0	1,323.0	400.0	923.0	3,139.0	1,000.0	1,990.0	50.0	48.5	-	-	50.5	-	-	-	-	VERMONT
VIRGINIA	12/31	5,210.5	1,371.5	1,091.8	279.7	3,839.0	1,014.3	732.0	1,062.3	518.7	8.8	3.2	499.7	-	-	-	-	VIRGINIA
WASHINGTON	12/31	3,283.5	576.3	554.9	111.4	2,607.3	-	1,970.1	-	31.4	2.9	38.5	550.1	14.3	-	-	-	WASHINGTON
WEST VIRGINIA	12/31	3,784.6	2,052.3	1,202.0	850.3	1,732.3	-	332.2	101.0	592.3	0.7	87.3	472.9	145.9	-	-	-	WEST VIRGINIA
WISCONSIN	12/31	10,279.6	1,859.2	767.9	1,091.3	8,420.4	91.8	6,046.2	178.9	33.0	-	-	2,070.5	-	-	-	-	WISCONSIN
WYOMING	12/31	3,136.2	2,207.1	1,607.7	599.4	929.1	-	876.3	14.6	-	-	27.1	11.1	-	-	-	-	WYOMING
TOTAL		287,928.2	124,868.9	96,412.7	28,456.2	163,059.3	11,395.7	79,286.1	18,428.4	12,927.1	890.2	4,815.5	31,935.8	3,215.8	87.8	33.9	43.0	TOTALS

NOTES:
(1) HIGHWAYS UNDER CONTROL OF STATE HIGHWAY DEPARTMENTS. DOES NOT INCLUDE ROADS UNDER COUNTY AND OTHER LOCAL CONTROL.
(2) APPROXIMATE. AS STATE DOES NOT SEGREGATE MILEAGE OF EARTH IMPROVED, GRAVEL AND WATERBOUND MACADAM.
(3) PASSAGE OF 100 MILLION DOLLAR BOND ACT ADDED 4560.0 MILES OF UNIMPROVED ROAD TO SYSTEM.
(4) LEGISLATURE ADDED 1546.6 MILES OF GRAVEL AND MACADAM ROADS TO SYSTEM.
(5) LEGISLATURE ADDED 1000.0 MILES OF UNIMPROVED ROADS TO SYSTEM.
(6) LEGISLATURE ADDED 1227.4 MILES TO SYSTEM FROM COUNTY ROADS (509.3 UNIMPROVED, 17.5 IMPROVED AND 700.8 MILES GRAVEL)
(7) EXCLUDES 249.0 MILES OF SYSTEM IN INCORPORATED CITIES AND TOWNS
(8) LEGISLATURE ADDED 187.0 MILES OF SAND-CLAY ROADS TO SYSTEM.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

M-4 (1925) REVISED
R. S. A.

STATE HIGHWAY SYSTEMS (1)

EXISTING MILEAGE AT END OF YEAR 1925

STATES	1925 YEAR ENDS	GRAND TOTAL MILEAGE, STATE HIGHWAY SYSTEM	EARTH ROADS, NON-SURFACED			SURFACED ROADS BY TYPES												STATES
			TOTAL NON-SURFACED MILEAGE	UNIMPROVED, AND PARTLY GRADED	IMPROVED, TO ESTAB. GRADE AND DRAINED	TOTAL SURFACED MILEAGE	SAND-CLAY AND TOP-SOIL	GRAVEL, CHERT, SHALE ETC. (TREATED & UNTREATED)	WATERBOUND MACADAM (TREATED AND UNTREATED)	BITUMINOUS MACADAM BY PENETRATION	SHEET ASPHALT	BITUMINOUS CONCRETE	PORTLAND CEMENT CONCRETE	BLOCK PAVEMENTS				
														VITRIFIED BRICK	ASPHALT	WOOD	STONE	
ALABAMA	9/30	3,953.5	2,120.5	2,076.2	44.3	1,833.0	591.6	1,016.7	52.4	36.8	6.7	93.6	36.1	-	-	0.2	-	ALABAMA
ARIZONA	12/31	2,014.4	561.9	248.1	313.8	1,452.5	-	1,265.2	-	-	15.0	31.7	140.6	-	-	-	-	ARIZONA
ARKANSAS	12/31	8,295.0	4,500.0	3,860.0	640.0	3,795.0	-	2,913.0	217.0	156.0	32.0	271.0	206.0	-	-	-	-	ARKANSAS
CALIFORNIA	12/31	6,591.4	3,208.1	2,534.3	(2) 673.8	3,383.3	-	(2) 862.0	(2) 61.0	325.4	-	390.2	1,744.7	-	-	-	-	CALIFORNIA
COLORADO	12/31	8,932.8	5,476.0	4,844.2	631.8	3,456.8	-	3,231.7	-	-	-	5.9	219.2	-	-	-	-	COLORADO
CONNECTICUT	6/30	1,871.9	146.9	-	146.9	1,725.0	-	412.1	686.0	205.1	-	125.2	294.9	1.7	-	-	-	CONNECTICUT
DELAWARE	12/31	505.7	-	-	-	505.7	-	1.0	1.3	18.1	-	2.3	476.6	6.4	-	-	-	DELAWARE
FLORIDA	12/31	5,615.8	3,070.9	3,029.2	41.7	2,544.9	789.8	8.3	802.6	177.6	206.3	33.7	131.6	337.0	58.0	-		FLORIDA
GEORGIA	12/31	6,231.7	3,759.2	3,629.4	129.8	2,472.5	1,542.2	498.3	48.8	118.6	34.9	9.2	219.9	0.6	-	-	-	GEORGIA
IDAHO	12/31	4,627.3	2,430.9	2,081.4	349.5	2,196.4	83.3	1,582.8	404.0	-	5.4	77.5	43.4	-	-	-	-	IDAHO
ILLINOIS	12/31	4,793.6	656.7	385.0	271.7	4,136.9	-	-	0.6	5.7	4.6	8.7	4,047.4	69.9	-	-	-	ILLINOIS
INDIANA	12/31	3,936.0	75.6	14.7	60.9	3,860.4	-	1,629.8	1,028.3	172.9	-	26.0	933.8	68.6	-	1.0	-	INDIANA
IOWA	12/31	6,674.1	3,644.7	1,848 7	1,796.0	3,029.4	-	2,460.8	-	-	-	-	535.3	33.3	-	-	-	IOWA
KANSAS	12/31	7,386 0	6,423.2	5,931.4	491.8	962.8	81.0	201.1	-	94.9	-	3.0	450.5	132.3	-	-	-	KANSAS
KENTUCKY	12/31	8,000.0	5,727.7	5,186.2	541.5	2,272.3	-	603.9	1,267.1	223.3	-	13.8	159.0	5.2	-	-	-	KENTUCKY
LOUISIANA	12/31	7,000.0	3,178.3	3,178.3	-	3,821.7	-	3,752.1	8.5	20.2	-	12.4	13.5	15.0	-	-	-	LOUISIANA
MAINE	12/31	1,459.4	240.7	240.7	-	1,218.7	7.3	950.9	7.5	197.1	-	-	55.9	-	-	-	-	MAINE
MARYLAND	9/30	2,275.8	-	-	-	2,275.8	-	332.0	1,058.8	-	37.9	24.3	821.5	1.3	-	-	-	MARYLAND
MASSACHUSETTS	11/30	1,541 8	12.7	-	12.7	1,529.1	-	133.3	344.8	655.5	-	192.7	200.1	0.8	-	0.1	1.8	MASSACHUSETTS
MICHIGAN	12/31	6,706.4	680.8	680.8	-	6,025.6	-	3,610.4	645.8	76.6	-	183.7	1,502.6	6.5	-	-	-	MICHIGAN
MINNESOTA	12/31	6,954.5	976.8	98.6	877.2	6,978.7	151.3	5,151.5	14.8	8.0	-	67.8	560.2	12.6	-	12.5	-	MINNESOTA
MISSISSIPPI	12/31	5,600.9	2,811.2	2,534.2	277.0	2,689.7	5.4	2,440.9	10.7	4.9	6.7	13.9	188.0	19.2	-	-	-	MISSISSIPPI
MISSOURI	12/31	7,640.0	5,086.9	3 149.0	1,937.9	2,553.1	-	1,481.4	-	94.4	-	-	960.4	16.9	-	-	-	MISSOURI
MONTANA	12/31	7,957.2	7,097.8	6,815.2	282.6	859.4	-	818.9	0.6	5.5	-	2.3	32.1	-	-	-	-	MONTANA
NEBRASKA	12/31	6,255.9	4,325.7	3,453.9	871.8	1,930.2	315.1	1,523.4	-	-	2.6	8.7	60.9	19.6	-	-	-	NEBRASKA
NEVADA	12/31	2,996.7	2,123.1	1,928.6	194.5	873.6	10.1	791.4	-	22.1	-	3.2	46.8	-	-	-	-	NEVADA
NEW HAMPSHIRE	12/31	2,196.7	375.3	290.7	84.6	1,821.4	-	1,508.0	106.9	127.6	-	66.3	12.7	-	-	-	-	NEW HAMPSHIRE
NEW JERSEY	12/31	1,290.0	108.1	-	108.1	1,181.9	-	279.1	88.4	13.7	52.2	229.0	497.8	4.1	2.7	6.3	8.6	NEW JERSEY
NEW MEXICO	12/31	9,159.7	7,543.5	7,343.5	200.0	1,616.2	-	1,544.2	-	-	-	0.7	71.3	-	-	-	-	NEW MEXICO
NEW YORK	12/31	14,068.0	4,500.6	4,495.8	4.8	9,567.4	-	106.6	2,313.7	4,073.3	-	247.1	2,536.4	262.8	23.4	0.6	3.7	NEW YORK
NORTH CAROLINA	12/31	6,134.0	742.4	-	742.4	5,391.6	2,286.3	778.6	156.6	361.9	63.9	674.5	1,023.0	46.8	-	-	-	NORTH CAROLINA
NORTH DAKOTA	12/31	6,174.0	5,370.5	3,051.3	2,319.2	803.5	-	796.3	-	-	0.5	-	6.7	-	-	-	-	NORTH DAKOTA
OHIO	12/31	10,784.0	3,558.8	3,452.4	106.4	7,226.2	-	1,694.5	1,237.5	1,303.8	34.9	235.6	1,364.6	1,354.4	-	-	-	OHIO
OKLAHOMA	12/31	5,589.0	4,240.6	4,215.0	25.6	1,348.4	-	788.6	-	-	-	73.0	454.5	32.3	-	-	-	OKLAHOMA
OREGON	12/31	4,446.6	1,438.2	1,102.9	336.3	3,008.4	-	2,113.7	-	-	-	696.2	199.5	-	-	-	-	OREGON
PENNSYLVANIA	12/31	10,842.7	3,300.1	-	3,300.1	7,542.6	-	336.9	2,842.6	381.0	201.8	274.9	3,134.7	358.6	7.1	3.4	2.8	PENNSYLVANIA
RHODE ISLAND	12/31	768.5	362.7	362.7	-	405.8	-	19.0	105.5	95.9	5.6	134.4	45.5	-	-	-	-	RHODE ISLAND
SOUTH CAROLINA	12/31	4,951.0	1,730.2	1,688.4	41.8	3,220.8	2,643.6	279.6	27.3	11.2	65.9	49.0	144.2	-	-	-	-	SOUTH CAROLINA
SOUTH DAKOTA	12/31	5,919.0	3,895.0	1,720.9	2,174.1	2,023.0	20.4	2,001.3	-	-	-	-	1.3	-	-	-	-	SOUTH DAKOTA
TENNESSEE	12/31	5 046.4	1,716.9	1,481.3	234.6	3,330.5	-	1,532.2	1,080.4	479.0	35.0	66.7	137.2	-	-	-	--	TENNESSEE
TEXAS	12/31	18,728.0	9,946.6	8,882.8	1,063.8	8,781.4	424.2	5,354.3	739.6	1,601.2	19.6	25.0	535.3	82.2	-	-	-	TEXAS
UTAH	12/31	3,227.9	2,169.2	775.8	1,393.4	1,058.7	-	803.2	-	-	11.1	43.4	201.0	-	-	-	-	UTAH
VERMONT	12/31	4 453 0	1,453.0	503.0	950.0	3 000.0	1,000.0	1,875.0	50.0	41.0	-	-	34.0	-	-	-	-	VERMONT
VIRGINIA	12/31	5,077.3	1,517.3	1,259.2	258.1	3,660.0	921.8	710.2	1,028.6	456.9	8.8	3.2	430.5	-	-	-	-	VIRGINIA
WASHINGTON	12/31	3,265 3	724.0	558 0	166.0	2,542.3	-	1,910.0	-	40.0	2.0	40.0	536.0	14.3	-	-	-	WASHINGTON
WEST VIRGINIA	12/31	3,664.0	2,401.3	1,719.3	682.0	1,262.7	-	164.9	117.6	388.6	0.7	74.9	365.1	160.9	-	-	-	WEST VIRGINIA
WISCONSIN	12/31	10,264.5	2,286.5	822.1	1,464.4	7,978.0	152.0	6,747.2	145.7	111.6	-	-	1,821.5	-	-	-	-	WISCONSIN
WYOMING	12/31	3,143.3	2.341.5	1,797.5	544.0	801.8	-	755.5	8.1	-	-	27.1	11.1	-	-	-	-	WYOMING
TOTALS		274,910.7	130,066.6	103,270.7	26,786.9	144,854.1	11,026.3	68,770.8	16,709.0	12,105.3	853.0	4,560.7	27,644.9	3,052.9	91.2	24.1	16.9	TOTALS

NOTES: (1) ROADS UNDER CONTROL OF STATE HIGHWAY DEPARTMENTS. DOES NOT INCLUDE ROADS UNDER COUNTY AND LOCAL CONTROL.
(2) ESTIMATED, AS STATE DOES NOT SEGREGATE MILEAGE OF EARTH IMPROVED, GRAVEL AND WATERBOUND MACADAM.

BUREAU EXHIBIT ON DISPLAY AT RENO, NEVADA

As a unit in the general exhibit of the Department, at the Transcontinental Highways Exposition, which is being held at Reno, Nevada, from June 25 to July 31; the Bureau has on display the material shown at the Sesquicentennial Exposition at Philadelphia, together with some booths from the convention of the American Road Builders' Association at Chicago.

The Transcontinental Highways Exposition is intended to celebrate the completion of United States Route 40 across Nevada. Although a considerable portion of the road is still unimproved, it is expected that the entire route will be completed at an early date, and it is now in condition for travel without serious difficulty.

In addition to the Bureau exhibit, the general Departmental display includes material furnished by other bureaus, whose work is confined largely to the western States; such as, the Forest Service, Biological Survey, Extension Service, Bureau of Animal Industry, and the Bureau of Plant Industry.

Mr. P. A. Kersey of this Bureau has been appointed by the Office of Exhibits as representative in general charge of the Department exhibit. Additional personnel, including several men from the western districts of this Bureau, will be assigned by the various bureaus to demonstrate the subject matter of the display.

W. H. LYNCH MADE DISTRICT ENGINEER OF DISTRICT 5

To fill the vacancy caused by the death of Mr. Wonders, Mr. W. H. Lynch, who has occupied the position of acting district engineer for some time, was appointed district engineer of District 5, effective June 7, 1927. Future correspondence to the Omaha district office should be addressed to Mr. Lynch, under his new title.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

R.P.R.-F.A.-A-1
M- May 1927 - A

STATUS OF CURRENT FEDERAL AID ROAD WORK

FOR THE FISCAL YEAR ENDING JUNE 30, 1927

AS OF MAY 31, 1927

STATES	BALANCE OF FEDERAL AID FUND AVAILABLE FOR NEW PROJECTS	* UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			AMOUNT PAID STATES DURING FISCAL YEAR	COMPLETED AND PAID DURING FISCAL YEAR			AGREEMENTS NOW IN FORCE			P.S.& E. RECOMMENDED FOR APPROVAL BY DISTRICT ENGINEER			STATES
		FEDERAL AID	MILES		FEDERAL AID	MILES			FEDERAL AID	MILES		FEDERAL AID	MILES		FEDERAL AID	MILES		
			ORIGINAL	STAGE		ORIGINAL	STAGE			ORIGINAL	STAGE		ORIGINAL	STATE		ORIGINAL	STAGE	
ALABAMA	$ 3,017,687.90	$ 3,127,211.59	381.3		$ 136,676.57	14.3	1.9	$ 1,196,371.64	$ 889,114.85	101.9	4.6	$ 2,707,728.31	324.6		$ 556,158.85	71.0	1.9	ALABAMA
ARIZONA	2,907,281.77	768,754.15	72.7		608,802.02	31.2	4.4	598,366.76	525,632.71	48.9	0.4	768,754.15	72.8		608,802.02	31.2	4.4	ARIZONA
ARKANSAS	1,709,118.31	1,386,642.91	211.5		262,746.03	18.0		984,017.77	1,858,494.40	237.6		1,400,286.52	221.9		249,103.42	7.6		ARKANSAS
CALIFORNIA	4,134,817.82	3,457,220.34	154.0	0.4	99,161.19	6.6		2,880,034.77	3,861,460.35	243.2	17.3	3,210,396.83	140.3	0.4	346,984.70	20.3		CALIFORNIA
COLORADO	2,663,051.53	3,117,393.14	278.9	9.1	20,057.34	2.9		1,129,751.81	774,541.81	81.1		2,533,151.91	224.5	9.1	604,298.57	57.3		COLORADO
CONNECTICUT	594,440.45	1,477,884.88	64.0		290,040.13	13.0		613,841.51	343,414.74	20.1		1,571,918.24	64.3		196,006.77	12.7		CONNECTICUT
DELAWARE	181,219.01	249,574.80	24.5		63,316.77	8.4	1.9	450,337.15	563,906.82	35.2		259,069.80	25.1		53,821.77	7.8	1.9	DELAWARE
FLORIDA	1,181,124.55	3,777,276.07	186.3	24.8	398,091.78	24.2		1,376,934.48	1,803,550.28	112.2		3,344,828.19	177.9	24.8	830,539.66	32.6		FLORIDA
GEORGIA	1,290,161.10	4,587,746.91	375.5	119.4				2,218,124.61	2,869,016.13	338.3	44.0	3,942,518.59	346.8	85.7	645,228.32	28.7	33.7	GEORGIA
IDAHO	685,326.62	1,333,304.66	164.1	16.3	400,661.56	42.1	1.1	1,185,698.33	1,193,414.46	110.8	13.1	1,225,001.82	161.8	15.5	508,964.40	44.4	1.9	IDAHO
ILLINOIS	3,111,613.48	4,396,670.88	330.9		2,696,826.04	184.3		2,427,392.92	2,161,520.86	153.1	2.0	3,891,362.07	291.3		3,202,134.85	224.0		ILLINOIS
INDIANA	714,290.14	7,543,094.26	468.0	11.6	1,007,570.88	73.2		1,943,816.40	2,694,046.53	177.7		6,604,330.34	395.7	11.6	1,946,334.80	145.5		INDIANA
IOWA	128,597.69	5,849,382.90	538.8	223.1	1,270,144.71	86.1	19.8	2,579,620.78	2,356,134.60	353.4	61.4	6,664,258.20	596.0	229.9	455,269.41	28.9	13.0	IOWA
KANSAS	851,856.42	5,141,155.09	648.9	7.6	1,016,180.59	194.1	0.8	2,508,187.04	1,933,251.65	302.8	0.1	4,828,702.30	632.3	8.4	1,328,633.38	210.7		KANSAS
KENTUCKY	333,862.79	4,501,792.53	427.3	48.7	387,426.88	47.3	8.9	1,324,630.00	915,591.55	100.1	14.6	3,934,022.87	392.5	53.5	955,196.54	82.1	4.1	KENTUCKY
LOUISIANA	1,256,557.36	1,922,166.10	137.9		13,100.33	3.0		1,022,883.86	949,152.22	122.8		1,922,166.10	137.9		13,100.33	3.0		LOUISIANA
MAINE	1,250,418.90	821,344.43	63.4		215,406.00	17.0		863,450.78	665,945.28	54.0		965,300.43	69.0		171,450.00	11.4		MAINE
MARYLAND	72,752.09	373,185.64	33.9		589,300.00	59.0		650,106.91	411,947.05	54.5		373,185.64	33.9		589,300.00	59.0		MARYLAND
MASSACHUSETTS	2,293,842.16	1,287,714.57	77.8		190,341.12	10.9		772,908.90	768,667.53	35.9		1,277,522.17	77.4		200,533.52	11.3		MASSACHUSETTS
MICHIGAN	2,424,063.66	5,239,078.35	347.4	28.4	755,705.00	40.6	6.5	2,454,785.42	2,311,166.69	121.0	9.9	4,935,218.35	340.2	28.4	1,059,565.00	47.8	6.5	MICHIGAN
MINNESOTA	550,476.43	1,889,998.90	340.9	98.6	226,900.00	48.5	17.1	2,590,339.01	3,460,029.11	461.6	114.6	1,903,998.90	356.2	104.3	211,900.00	33.2	11.4	MINNESOTA
MISSISSIPPI	912,874.83	3,319,747.70	352.9	4.6	530,445.75	72.0	10.2	1,366,790.28	1,258,294.62	165.2		3,101,070.52	314.6		749,122.93	110.3	14.8	MISSISSIPPI
MISSOURI	1,329,994.16	4,204,049.48	302.5	34.3	599,394.16	52.5	12.9	3,751,161.16	5,322,158.35	359.8	29.6	3,404,527.98	239.6	29.5	1,398,915.66	115.4	17.7	MISSOURI
MONTANA	4,811,145.73	1,370,643.96	126.1	5.7	1,507,305.62	263.1		643,138.04	953,822.80	96.7	62.6	1,812,999.59	229.1	5.7	1,064,949.99	160.1		MONTANA
NEBRASKA	1,462,788.14	5,655,666.07	1201.3	568.3	1,485,232.10	231.1	252.3	2,275,246.62	2,142,485.17	440.9	238.6	5,328,330.82	1183.2	571.4	1,812,566.35	249.2	249.2	NEBRASKA
NEVADA	834,864.35	1,395,831.20	196.5	26.2				1,009,951.08	2,382,094.86	301.0	11.0	1,387,215.48	196.5	26.2	8,615.72			NEVADA
NEW HAMPSHIRE	257,173.36	351,317.49	22.8		147,698.10	8.8		420,511.80	401,477.98	27.2		288,800.11	18.0		210,215.48	13.6		NEW HAMPSHIRE
NEW JERSEY	200,057.96	1,273,543.56	82.8		433,065.00	29.9		732,592.69	2,397,022.27	26.0		1,016,098.56	65.6		690,510.00	46.1		NEW JERSEY
NEW MEXICO	1,635,135.72	2,596,588.47	233.6					956,066.52	587,767.43	78.2		1,925,987.76	216.2		670,600.71	17.4		NEW MEXICO
NEW YORK	5,038,284.90	8,800,778.95	549.5		2,227,927.50	130.0	8.6	4,314,424.98	3,701,463.46	236.9		9,913,013.95	612.8		1,115,692.50	66.7	8.6	NEW YORK
NORTH CAROLINA	1,287,763.17	1,191,705.92	78.0		432,189.75	26.5	12.2	2,333,455.65	3,341,565.22	202.2	37.5	1,191,705.92	78.0		432,189.75	26.5	12.2	NORTH CAROLINA
NORTH DAKOTA	583,461.11	2,687,652.06	704.3	129.3	930,501.95	271.4	281.2	2,471,050.99	1,710,135.10	522.4	362.9	2,744,074.10	708.1	172.3	874,079.91	267.6	238.2	NORTH DAKOTA
OHIO	4,528,632.77	4,389,902.25	329.8	4.1	244,093.22	13.0		2,491,989.85	1,959,589.73	150.8	13.5	4,341,168.37	322.2	4.1	292,827.10	20.6		OHIO
OKLAHOMA	1,494,408.94	1,433,037.86	196.3	17.9	766,641.99	126.3	20.7	1,339,252.44	957,590.06	89.2	10.1	1,915,123.43	272.1	30.9	284,556.42	50.5	7.7	OKLAHOMA
OREGON	718,329.08	1,239,049.68	57.6	35.8	196,950.85	25.0		1,228,335.54	1,314,004.60	105.6		1,238,013.85	57.6	35.8	197,986.68	25.0		OREGON
PENNSYLVANIA	2,901,007.51	5,044,782.32	333.7		927,083.64	57.3		3,042,605.21	4,240,910.49	311.3		5,257,089.38	348.0		714,776.58	43.0		PENNSYLVANIA
RHODE ISLAND	591,239.94	205,665.00	13.7		237,810.00	15.8		466,586.24	439,650.00	29.3		279,840.00	18.6		163,635.00	10.9		RHODE ISLAND
SOUTH CAROLINA	490,897.83	2,607,525.08	209.3	19.2	231,100.29	29.4		972,872.99	760,665.87	86.5	15.4	2,249,317.46	194.9	8.0	589,307.91	43.8	11.2	SOUTH CAROLINA
SOUTH DAKOTA	758,509.85	1,753,802.29	574.7	22.3	357,016.32	128.5	66.2	1,063,929.81	903,698.57	321.7	154.4	1,667,246.89	544.2	56.3	443,571.72	159.0	32.2	SOUTH DAKOTA
TENNESSEE	1,885,627.52	3,503,402.56	235.9	42.8				1,697,271.79	1,229,742.90	78.5	19.1	3,324,814.29	212.9	42.8	178,588.27	23.0		TENNESSEE
TEXAS	6,244,748.45	6,773,705.87	534.8	192.6	608,645.18	53.4	35.6	4,448,699.93	4,036,348.78	537.3	39.9	6,521,563.92	522.4	190.3	860,787.13	65.8	37.9	TEXAS
UTAH	961,836.52	1,672,855.84	161.9		263,912.69	30.1		725,313.98	668,639.27	82.5		1,518,688.85	158.1		418,079.68	33.9		UTAH
VERMONT	137,143.56	819,113.52	41.7		329,018.91	21.5		618,175.16	331,156.50	18.2		548,585.08	24.9		599,547.35	38.3		VERMONT
VIRGINIA	182,759.45	1,897,303.04	105.3		393,530.29	21.9	4.0	1,774,048.01	2,084,907.11	157.6		1,855,336.47	105.5		435,496.86	21.7	4.0	VIRGINIA
WASHINGTON	1,215,156.05	1,750,600.00	68.2		65,000.00	10.2		1,146,672.36	463,642.49	42.6		1,750,600.00	68.2		65,000.00	10.2		WASHINGTON
WEST VIRGINIA	583,218.82	2,934,191.86	238.2	12.0	54,988.32	5.7		634,227.01	432,685.36	26.5		2,841,704.96	237.1	12.0	147,475.21	6.8		WEST VIRGINIA
WISCONSIN	2,828,352.93	3,786,749.30	328.1	19.7	949,398.50	56.8	21.5	2,350,900.87	1,352,063.54	130.4	7.8	2,989,123.09	280.4	6.8	1,747,024.71	104.5	34.4	WISCONSIN
WYOMING	1,096,655.73	1,222,454.22	122.1	33.7	42,256.00	16.7		696,804.42	1,098,380.00	182.3	32.8	1,025,687.63	104.2	33.7	239,022.59	34.6		WYOMING
HAWAII	906,975.36	562,362.64	29.7					215,625.47	97,440.00	6.5		562,362.64	29.7					HAWAII
TOTALS	$ 77,140,603.92	$ 136,692,620.28	12759.3	1756.5	$ 24,608,660.07	2620.6	787.8	$ 77,159,302.74	$ 79,879,412.15	8079.4	1317.2	$ 130,163,811.83	12445.1	1797.4	$ 31,137,468.52	2935.0	746.9	TOTALS

* INCLUDES PROJECTS REPORTED COMPLETED (FINAL VOUCHERS NOT YET PAID) TOTALING: FEDERAL AID $30,543,223.16; MILEAGE ORIGINAL 2757.8; MILEAGE STAGE 538.3

(Not for release)

PRESENT STATUS OF UNITED STATES ROUTES 40, 41, 51, 61, AND 66

Contributed by F. W. Mills of the Division of Design

United States route 40-North is 65 per cent improved with gravel, and the higher types of surfacing. Another 21 per cent consists of graded and drained road, and the balance is unimproved. The route is surfaced continuously from Atlantic City, across New Jersey, Delaware, Maryland, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Missouri, practically to St. Marys, Kans., - a distance of 1,300 miles - with the exception of 4.23 miles of earth road in Pennsylvania. West of St. Marys, in Kansas, and through the western States of Colorado, Utah, Nevada, and California, the route is surfaced for 42 per cent of the 1,906-mile distance with gravel, or better. Of the remainder, 35 per cent is unsurfaced earth road, and 23 per cent is unimproved. The total length of the route, from Atlantic City to San Francisco, is 3,205 miles.

A detailed statement of the condition of the road, as determined by a Bureau survey, follows:

UNITED STATES ROUTE 40-NORTH

State	City or town	Type	Miles	Total
New Jersey	From Atlantic City			
	via Mays Landing			
	Woodstown	Concrete, and		
	Penns Grove	bit. concrete	37.82	
	to Wilmington, Del.	Macadam	6.05	
	by ferry	Gravel	21.90	65.77
Delaware	From Wilmington			
	via Marshallton	Concrete, and		
	to Md. State line	bit. concrete		18.80
Maryland	From Del. State line			
	via Elkton			
	Aberdeen			
	Baltimore			
	Frederick			
	Hagerstown			
	Cumberland	Concrete, and		
	Frostburg	macadam for		
	Keysers Bridge	entire dis-		
	to Penna. State line	tance		225.70

UNITED STATES ROUTE 40-NORTH (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
PENNSYLVANIA	FROM MD. STATE LINE			
	VIA FARMINGTON			
	UNIONTOWN	BRICK,		
	WASHINGTON	CONCRETE, OR		
	TO W.VA. STATE LINE	BIT.MACADAM	76.77	
	AT WEST ALEXANDER	EARTH	4.23	81.00
WEST VIRGINIA	FROM PENNA.STATE LINE			
	VIA RONEYS POINT			
	ELM GROVE	CONCRETE, OR		
	TO OHIO STATE LINE	BIT. MACADAM		15.30
OHIO	FROM W. VA. STATE LINE			
	VIA CAMBRIDGE			
	COLUMBUS			
	SPRINGFIELD			
	BRANDT	BRICK, CON-		
	ENGLEWOOD	CRETE, OR		
	TO IND. STATE LINE	BIT. MACADAM		225.00
INDIANA	FROM OHIO STATE LINE			
	VIA RICHMOND			
	INDIANAPOLIS			
	BRAZIL	BRICK	7.4	
	TERRE HAUTE	CONCRETE	138.88	
	TO ILL. STATE LINE	BIT. MACADAM	4.52	150.80
ILLINOIS	FROM IND. STATE LINE			
	VIA MARSHALL			
	EFFINGHAM			
	VANDALIA	PAVED FOR		
	TO MO. STATE LINE	ENTIRE DIS-		
	AT EAST ST. LOUIS	TANCE		161.3
MISSOURI	FROM ILL. STATE LINE			
	AT ST. LOUIS			
	VIA ST. CHARLES			
	COLUMBIA			
	BOONVILLE	PAVED FOR		
	TO KANS. STATE LINE	ENTIRE DIS-		
	AT KANSAS CITY	TANCE		256.00

UNITED STATES ROUTE 40-NORTH (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
KANSAS	FROM MO. STATE LINE			
	AT KANSAS CITY			
	VIA OSKALOOSA			
	LAWRENCE			
	TOPEKA			
	MANHATTAN			
	CLAY CENTER			
	BELOIT			
	OSBORNE	CONCRETE	100.6	
	HILL CITY	GRAVEL	72.7	
	COLBY	EARTH	268.1	
	GOODLAND	GRADED AND		
	TO COLO. STATE LINE	DRAINED	23.9	465.3
COLORADO	FROM KANS. STATE LINE			
	AT KANORADO			
	VIA BURLINGTON			
	LIMON	CONCRETE	20.30	
	DENVER	GRAVEL	37.82	
	HOT SULPHUR SPGS.	GRADED AND		
	CRAIG	DRAINED	287.28	
	TO UTAH STATE LINE	UNIMPROVED	166.80	512.20
UTAH	FROM COLO. STATE LINE			
	VIA VERNAL			
	DUCHESNE			
	HEBER			
	PARK CITY			
	SALT LAKE CITY	CONCRETE, AND		
	GRANTSVILLE	BIT. CONCRETE	81.18	
	WENDOVER	GRAVEL	106.7	
	TO NEV. STATE LINE	UNIMPROVED	183.2	371.05
NEVADA	FROM UTAH STATE LINE			
	VIA WELLS			
	HALLECK			
	ELKO			
	BATTLE MOUNTAIN			
	WINNEMUCCA			
	LOVELOCK	CONCRETE	16.30	
	WADSWORTH	GRAVEL	300.08	
	RENO	GRADED AND		
	TO CALIF. STATE LINE	DRAINED	13.57	
	WEST OF VERDI	UNIMPROVED	94.17	424.12

UNITED STATES ROUTE 40-NORTH (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
CALIFORNIA	FROM NEV. STATE LINE			
	VIA TRUCKEE			
	AUBURN			
	SACRAMENTO			
	DAVIS	CONCRETE, AND		
	MARTINEZ	BIT. CONCRETE	141.66	
	OAKLAND	BIT. MACADAM	16.50	
	FERRY OVER BAY TO	GRADED AND		
	SAN FRANCISCO	DRAINED	74.84	233.00
		TOTAL MILES		3,205.34

SUMMARY OF TYPES
UNITED STATES ROUTE 40-NORTH

	MILES	PER CENT
HARD SURFACE PAVEMENT, INCLUDING BRICK, CONCRETE, MACADAM, AND BITUMINOUS MACADAM	1,550.05	48.4
GRAVEL	539.20	16.8
EARTH, AND GRADED AND DRAINED ROADS	671.92	20.9
UNIMPROVED	444.17	13.9
TOTAL	3,205.34	100.0

United States route 41 is 85 per cent improved with gravel, and the higher types of surfacing. The remaining 15 per cent includes unsurfaced earth roads, unimproved sections, and bridges. With the exception of 3.4 miles of unimproved road in Indiana, between Boston and Hammond, along Lake George, there is a continuously surfaced road for a distance of 805 miles; beginning a short distance north of Powers, Mich., and extending through Wisconsin, Illinois, Indiana, and Kentucky, to Murfreesboro, Tenn.

In Michigan, Tennessee, Georgia, and Alabama, the surfaced sections total 77 per cent; the unsurfaced earth roads, 10 per cent; and the unimproved units aggregate 13 per cent. The total length of United States route 41 is 1,925 miles.

UNITED STATES ROUTE 41

State	City or town	Type	Miles	Total
Michigan	From Eagle Harbor			
	via Houghton			
	L'Anse			
	Marquette			
	Princeton	Concrete	20.00	
	Powers	Macadam	42.00	
	Menominee	Gravel	91.00	
	to Wis. State line	Unimproved	70.00	223.00
Wisconsin	From Mich. State line			
	via Oronto			
	Green Bay			
	Appleton			
	Oshkosh			
	Fond du Lac			
	Milwaukee			
	Thompsonville			
	Sylvania	Concrete	182.00	
	to Ill. State line	Gravel	56.00	238.00
Illinois	From Wis. State line			
	via Chicago			
	to Ind. State line			
	at South Chicago	Concrete		67.00

UNITED STATES ROUTE 41 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
INDIANA	FROM ILL. STATE LINE			
	VIA HAMMOND			
	KENTLAND			
	BOSWELL			
	ATTICA			
	TERRE HAUTE			
	SULLIVAN			
	VINCENNES			
	PRINCETON	CONCRETE	217.06	
	EVANSVILLE	GRAVEL	49.50	
	TO KY. STATE LINE	UNIMPROVED	3.40	269.96
KENTUCKY	FROM IND. STATE LINE			
	VIA HENDERSON			
	DIXON			
	MADISONVILLE			
	HOPKINSVILLE			
	TO TENN. STATE LINE NORTHWEST OF CLARKSVILLE, TENN.	GRAVEL		103.92
TENNESSEE	FROM KY. STATE LINE			
	VIA CLARKSVILLE			
	ASHLAND			
	NASHVILLE			
	MURFREESBORO			
	MANCHESTER			
	JASPER	CONCRETE, OR		
	ST. ELMO	MACADAM	85.3	
	CHATTANOOGA	GRAVEL	104.7	
	TO GA. STATE LINE	EARTH	27.0	217.0
GEORGIA	FROM TENN. STATE LINE			
	VIA RINGGOLD			
	DALTON			
	CARTERSVILLE	BRICK, CON-		
	ATLANTA	CRETE, OR		
	GRIFFIN	BIT. CONCRETE	153.32	
	MACON	MACADAM	58.17	
	PERRY	CHERT AND		
	TIFTON	GRAVEL	49.68	
	VALDOSTA	EARTH	56.12	
	TO FLA. STATE LINE	UNIMPROVED	66.81	384.10

UNITED STATES ROUTE 41 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
FLORIDA	FROM GA. STATE LINE			
	VIA JASPER	BRICK, OR		
	LAKE CITY	CONCRETE	42.34	
	GAINESVILLE	MACADAM	296.96	
	OCALA	SHELL	13.8	
	TAMPA	GRADED AND		
	BRADENTON	DRAINED	36.01	
	FORT MYERS	UNIMPROVED	30.5	
	TO NAPLES	BRIDGES	2.22	421.83
		TOTAL MILES		1,924.81

SUMMARY OF TYPES
UNITED STATES ROUTE 41

	MILES	PER CENT
HARD SURFACE PAVEMENT, INCLUDING BRICK, CONCRETE, AND MACADAM,	1,164.15	60.5
GRAVEL, AND SHELL	468.60	24.3
EARTH, AND GRADED AND DRAINED ROADS	119.13	6.2
UNIMPROVED	170.71	8.9
BRIDGES	2.22	0.1
TOTAL	1,924.81	100.0

UNITED STATES ROUTE 51 IS 84 PER CENT SURFACED WITH SAND-CLAY, GRAVEL, AND THE HIGHER TYPES OF SURFACE. ANOTHER 9 PER CENT CONSISTS OF UNSURFACED EARTH ROAD, AND THE BALANCE IS UNIMPROVED. THERE IS NO CONSIDERABLE DISTANCE OF CONTINUOUSLY SURFACED ROAD ON THIS ROUTE, AND THERE ARE UNIMPROVED SECTIONS IN EVERY STATE EXCEPTING WISCONSIN, AND KENTUCKY. IN THE FORMER, THERE IS AN UNSURFACED SECTION 76 MILES IN LENGTH. THE SHORT CROSSING OF KENTUCKY, 40 MILES LONG, IS COMPLETELY SURFACED.

UNITED STATES ROUTE 51

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
WISCONSIN	ROUTE 2 - FROM SUPERIOR	GRAVEL	86.5	
	VIA ASHLAND	CONCRETE	17.7	
	TO HURLEY	SAND-CLAY	8.6	112.8
	ROUTE 51 - FROM HURLEY			
	VIA MINOCQUA			
	TOMAHAWK			
	MERRILL			
	WAUSAU			
	STEVENS POINT			
	PORTAGE			
	MADISON	CONCRETE	77.0	
	JANESVILLE	BIT. MACADAM	24.6	
	TO ILL. STATE LINE	GRAVEL	172.3	
	AT BELOIT	EARTH	75.7	349.6

UNITED STATES ROUTE 51 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
ILLINOIS	FROM WIS. STATE LINE			
	VIA ROCKFORD			
	ROCHELLE			
	MENDOTA			
	LASALLE			
	BLOOMINGTON			
	DECATUR			
	VANDALIA			
	DUQUOIN	CONCRETE	331.95	
	CARBONDALE	CITY PAVE-		
	ANNA	MENT	36.65	
	TO KY. STATE LINE	GRAVEL	3.40	
	AT CAIRO	UNIMPROVED	43.00	415.00
KENTUCKY	FROM ILL. STATE LINE			
	AT WICKLIFFE			
	VIA BARDWELL			
	ARLINGTON			
	CLINTON	CITY PAVE-		
	TO TENN. STATE LINE	MENT	1.00	
	SOUTH OF FULTON	GRAVEL	38.92	39.92
TENNESSEE	FROM KY. STATE LINE			
	VIA UNION CITY	CONCRETE, AND		
	DYERSBURG	BIT. CONCRETE	49.53	
	RIPLEY	CITY PAVEMENT	10.95	
	MEMPHIS	BIT. MACADAM	28.93	
	TO MISS. STATE LINE	GRAVEL	38.04	
	NORTH OF HORN LAKE	UNIMPROVED	19.55	147.00
MISSISSIPPI	FROM TENN. STATE LINE			
	VIA BATESVILLE			
	GRENADA	BRICK, CON-		
	CANTON	CRETE, CITY		
	JACKSON	PAVEMENT, AND		
	HAZLEHURST	BIT. CONCRETE	19.39	
	BROOKHAVEN	GRAVEL	219.29	
	TO LA. STATE LINE	EARTH	55.76	
	SOUTH OF OSYKA	UNIMPROVED	21.00	315.44
LOUISIANA	FROM MISS. STATE LINE			
	VIA AMITE	S.T. MACADAM	46.76	
	HAMMOND	SHELL	24.46	
	TO NEW ORLEANS	UNIMPROVED	21.13	92.35

TOTAL MILES 1,472.11

Summary of Types
United States Route 51

	Miles	Per cent
Hard surface pavements, including brick, concrete, city pavement, bituminous concrete and macadam, and surface treated macadam	644.46	43.8
Gravel, shell, and sand-clay	591.51	40.2
Earth	131.46	8.9
Unimproved	104.68	7.1
Total	1,472.11	100.0

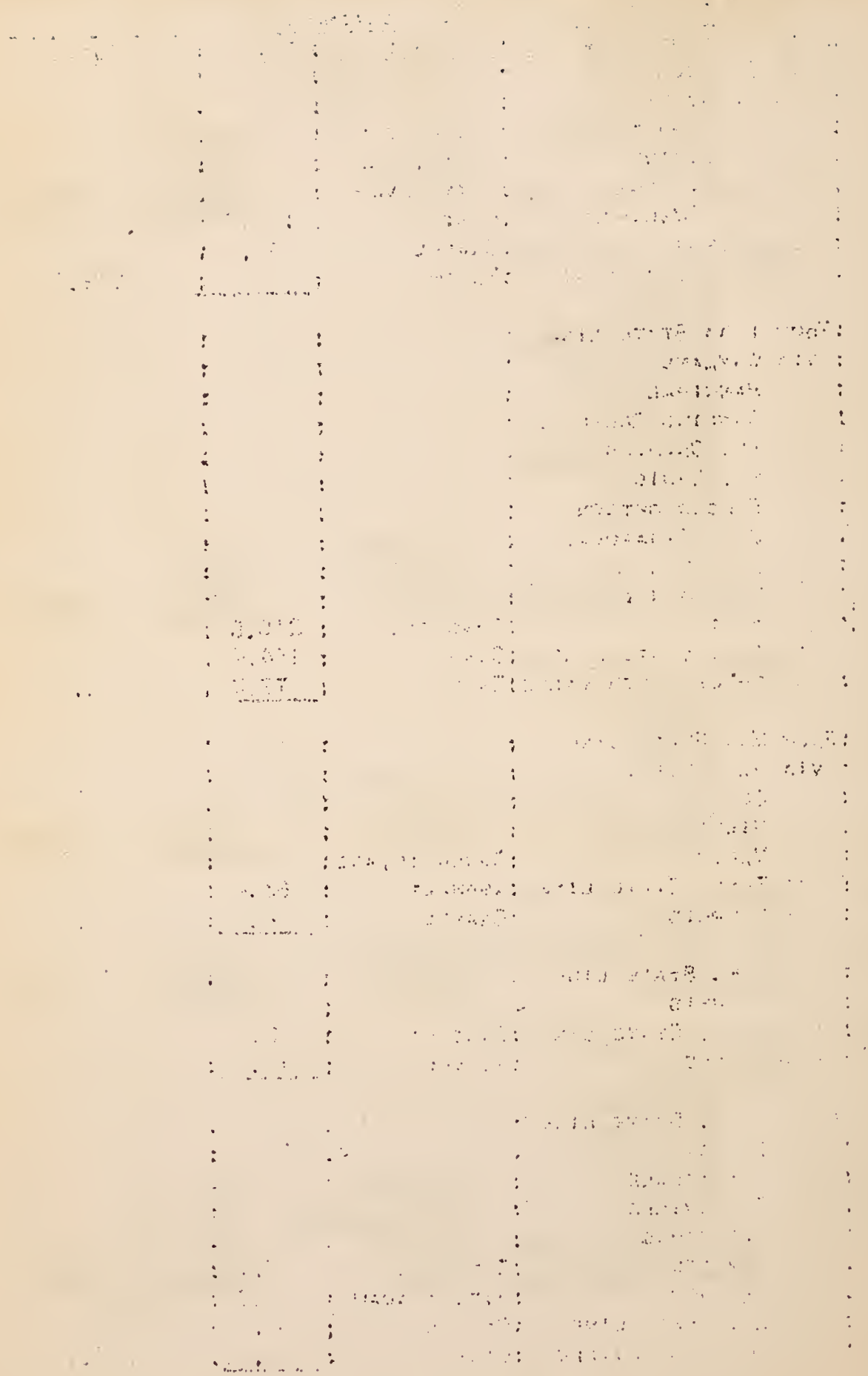
United States route 61 is 91 per cent surfaced with gravel, and the higher types of surface. The other 9 per cent consists of unsurfaced earth roads. There are no unimproved sections on this route. There is no extensive length of continuously surfaced road, since the earth sections are scattered through all the States, with the exception of Arkansas, and Tennessee; and in these States the distances are relatively short - 82 miles. The total length of the route is 1,850 miles.

UNITED STATES ROUTE 61

State	City or town	Type	Miles	Total
Minnesota	From U.S.-Canadian bor-			
	der near Grand Portage			
	via Grand Marais			
	Two Harbors			
	Duluth			
	Pine City			
	St. Paul			
	Hastings			
	Red Wing			
	Wabasha	Brick, or		
	Winona	concrete	265.8	
	to Wis. State line	Gravel	191.7	
	at La Crescent	Graded	8.5	466.0
Wisconsin	From Minn. State line			
	via La Crosse	Concrete, and		
	Viroqua	city pave-		
	Prairie du Chien	ment	18.3	
	Lancaster	Bit.macadam	12.7	
	to East Dubuque	Gravel, and		
	across Mississippi	cr. stone	81.1	
	River into Iowa	Earth	16.9	129.0

UNITED STATES ROUTE 61 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
IOWA	FROM DUBUQUE			
	VIA MAQUOKETA			
	DAVENPORT	BRICK, CONCRETE, AND CITY PAVEMENT		
	MUSCATINE			
	BURLINGTON			
	FORT MADISON		119.7	
	KEOKUK	GRAVEL	36.0	
	TO MO. STATE LINE	EARTH	46.3	202.0
MISSOURI	FROM IOWA STATE LINE			
	VIA WAYLAND			
	HANNIBAL			
	BOWLING GREEN			
	ST. CHARLES			
	ST. LOUIS			
	FREDERICKTOWN			
	CAPE GIRARDEAU			
	SIKESTON			
	NEW MADRID			
	HAYTI	CONCRETE	210.5	
	TO ARK. STATE LINE	GRAVEL	154.4	
	NORTH OF BLYTHEVILLE	EARTH	79.2	444.1
ARKANSAS	FROM MO. STATE LINE			
	VIA BLYTHEVILLE			
	OSCEOLA			
	GILMORE			
	MARION	CONCRETE, AND ASPHALT		
	TO TENN. STATE LINE		63.4	
	AT MEMPHIS	GRAVEL	4.8	68.2
TENNESSEE	FROM ARK. STATE LINE			
	AT MEMPHIS			
	TO MISS. STATE LINE	CONCRETE	2.0	
	NEAR WALLS	GRAVEL	12.0	14.0
MISSISSIPPI	FROM TENN. STATE LINE			
	VIA TUNICA			
	CLARKSDALE			
	GREENVILLE			
	VICKSBURG			
	FAYETTE	CONCRETE	37.1	
	NATCHEZ	BIT. MACADAM	9.7	
	TO LA. STATE LINE	GRAVEL	303.1	
	SOUTH OF WOODVILLE	EARTH	12.2	362.1



UNITED STATES ROUTE 61 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
LOUISIANA	FROM MISS. STATE LINE			
	VIA ST. FRANCISVILLE			
	BATON ROUGE	CITY PAVE-		
	CONVENT	MENT	14.3	
	TO NEW ORLEANS	GRAVEL	150.7	165.0

TOTAL MILES 1,850.4

SUMMARY OF TYPES
UNITED STATES ROUTE 61

	MILES	PER CENT
HARD SURFACE PAVEMENTS, INCLUDING BRICK, CONCRETE, CITY PAVEMENT, ASPHALT, AND BITUMINOUS MACADAM	753.5	40.7
GRAVEL, AND CRUSHED STONE	933.8	50.5
EARTH, AND GRADED AND DRAINED ROADS	163.1	8.8
TOTAL	1,850.4	100.0

UNITED STATES ROUTE 66 IS 50 PER CENT SURFACED WITH GRAVEL, AND THE HIGHER TYPES OF SURFACE. ANOTHER 24 PER CENT CONSISTS OF UNSURFACED EARTH ROAD, AND THE BALANCE IS UNIMPROVED. THERE IS A CONTINUOUS PAVEMENT FROM CHICAGO TO CUBA, MO., AND MUCH OF THE BALANCE OF THE ROUTE IN MISSOURI IS SIMILARLY IMPROVED. THE TOTAL LENGTH OF THE ROUTE IS 2,448 MILES.

UNITED STATES ROUTE 66

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
ILLINOIS	FROM CHICAGO			
	VIA JOLIET			
	DWIGHT			
	BLOOMINGTON			
	SPRINGFIELD	BRICK, OR		
	CARLINVILLE	CONCRETE		
	LITCHFIELD	PAVEMENT FOR		
	TO MO. STATE LINE	ENTIRE DIS-		
	AT EAST ST. LOUIS	TANCE		303.0

UNITED STATES ROUTE 66 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
MISSOURI	FROM ILL. STATE LINE			
	VIA PACIFIC			
	SULLIVAN	REIN. CON-		
	CUBA	CRETE, AND		
	ROLLA	CONCRETE	132.6	
	LEBANON	MACADAM	8.2	
	SPRINGFIELD	GRAVEL	18.6	
	CARTHAGE	GRADED AND		
	JOPLIN	DRAINED	105.0	
	TO KANS. STATE LINE	UNIMPROVED	41.6	306.0
KANSAS	FROM MO. STATE LINE			
	VIA GALENA			
	BAXTER SPRINGS			
	TO OKLA. STATE LINE	CONCRETE	10.0	
	SOUTH OF BAXTER SPGS.	GRAVEL	2.9	12.9
OKLAHOMA	FROM KANS. STATE LINE			
	VIA MIAMI			
	VINITA			
	TULSA			
	CHANDLER			
	OKLAHOMA CITY			
	EL RENO			
	BRIDGEPORT			
	CLINTON	CONCRETE, BIT.		
	ELK CITY	CONCRETE, OR		
	SAYRE	S.T. GRAVEL	124.3	
	TO TEX. STATE LINE	GRAVEL	9.7	
	WEST OF TEXOLA	EARTH, GRADED	301.0	435.0
TEXAS	FROM OKLA. STATE LINE			
	VIA CLAUDE	BIT. MACADAM		
	AMARILLO	OR S. T.		
	ONTARIO	GRAVEL	25.4	
	TO N.MEX. STATE LINE	EARTH, GRADED	89.3	
	WEST OF GLENRIO	UNIMPROVED	72.3	187.0
NEW MEXICO	FROM TEX. STATE LINE			
	VIA TUCUMCARI			
	SANTA ROSA	CONCRETE, BIT.		
	SANTA FE	CONCRETE, OR		
	ALBUQUERQUE	BIT. MACADAM	122.0	
	LOS LUNAS	GRAVEL	204.0	
	GRANT	GRADED AND		
	GALLUP	DRAINED	61.6	
	TO ARIZ. STATE LINE	UNIMPROVED	112.6	500.2

UNITED STATES ROUTE 66 (CONTINUED)

STATE	CITY OR TOWN	TYPE	MILES	TOTAL
ARIZONA	FROM N. MEX. STATE LINE			
	VIA NAVAJO			
	HOLBROOK			
	HARDY			
	FLAGSTAFF			
	WILLIAMS			
	ASHFORK	BIT. CONCRETE	5.1	
	SELIGMAN	GRAVEL	131.3	
	PEACH SPRINGS	GRADED AND		
	KINGMAN	DRAINED	36.5	
	TO CAL. STATE LINE	UNIMPROVED	234.1	407.0
CALIFORNIA	FROM ARIZ. STATE LINE			
	WEST OF TOPOCK			
	VIA NEEDLES			
	DAGGETT	CONCRETE, AND		
	BARSTOW	BIT. MACADAM	82.0	
	SAN BERNARDINO	GRAVEL	44.7	
	TO LOS ANGELES	UNIMPROVED	170.6	297.3
		TOTAL MILES.....		2,448.4

SUMMARY OF TYPES
UNITED STATES ROUTE 66

	MILES	PER CENT
HARD SURFACE PAVEMENTS, INCLUDING BRICK, REINFORCED CONCRETE, CONCRETE, BITUMINOUS CONCRETE, BITUMINOUS MACADAM, AND SURFACE TREATED GRAVEL	804.4	32.9
GRAVEL, AND MACADAM	419.4	17.1
EARTH, AND GRADED AND DRAINED ROADS	593.4	24.2
UNIMPROVED	631.2	25.8
TOTAL	2,448.4	100.0

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

1-1 (1927) (REVISED)
S. S. A.

PROGRAM OF ESTIMATED STATE AND LOCAL HIGHWAY AND BRIDGE EXPENDITURES

FOR CALENDAR YEAR - 1927.

STATES	GRAND TOTAL EXPENDITURES (ESTIMATED) ON STATE AND LOCAL ROADS	PROBABLE EXPENDITURES BY STATE HIGHWAY DEPARTMENTS							PROBABLE EXPENDITURES ON ROADS AND BRIDGES BY LOCAL AUTHORITIES	ESTIMATED ROAD MILEAGE TO BE BUILT BY STATE HIGHWAY DEPARTMENTS.				MILES OF ROAD MAINTAINED BY STATE HIGHWAY DEPARTMENT	STATES
		TOTAL STATE ROAD EXPENDITURES	CONSTRUCTION EXPENDITURES			MAINTENANCE (1)		MISCELLANEOUS INCLUDING OVERHEAD (2)		TOTAL MILEAGE	EARTH IMPROVED	SAND-CLAY, GRAVEL, AND MACADAM	ASPHALT, CONCRETE, AND BRICK		
			TOTAL ROADS AND BRIDGES	ROADS	BRIDGES	RECONSTRUCTION	ROAD UPKEEP								
ALABAMA	$ 20,950,000	$ 10,950,000	$ 9,500,000	$ 8,000,000	$ 1,500,000	$ -	$ 750,000	$ 700,000	$ 10,000,000	405	67	279	60	2,700	ALABAMA
ARIZONA	3,600,000	2,900,000	2,200,000	2,000,000	200,000	-	700,000	-	700,000	100	30	67	3	1,620	ARIZONA
ARKANSAS	16,000,000	6,900,000	4,600,000	4,000,000	600,000	-	2,000,000	300,000	9,100,000	580	280	300	30	7,500	ARKANSAS
CALIFORNIA	42,550,000	15,550,000	3,280,000	2,500,000	780,000	6,500,000	5,000,000	770,000	27,000,000	80	-	65	15	5,131	CALIFORNIA
COLORADO	9,020,000	6,020,000	4,090,000	3,590,000	500,000	NONE	1,600,000	330,000	3,000,000	124	32	49	43	8,647	COLORADO
CONNECTICUT (19)	12,875,000	10,875,000	5,200,000	4,700,000	500,000	3,250,000	2,000,000	425,000	(14)2,000,000	100	-	52	48	1,952	CONNECTICUT
DELAWARE	2,625,000	2,325,000	2,000,000	1,600,000	400,000	-	200,000	125,000	300,000	75	-	15	60	600	DELAWARE
FLORIDA	38,674,800	18,674,800	16,557,320	13,057,320	3,500,000	-	1,977,480	140,000	20,000,000	775	275	100	400	2,104	FLORIDA
GEORGIA	23,600,000	10,100,000	7,800,000	6,900,000	900,000	100,000	1,600,000	600,000	13,500,000	506	100	250	156	5,300	GEORGIA
IDAHO	3,280,000	2,780,000	1,700,000	1,200,000	500,000	300	(3)1,019,700	60,000	500,000	145	25	105	15	2,200	IDAHO
ILLINOIS	68,091,000	41,091,000	36,849,000	33,261,200	3,587,800	-	2,750,000	(4) 1,492,000	27,000,000	1,256	219	-	1,036	5,857	ILLINOIS
INDIANA	39,840,000	14,840,000	11,000,000	9,500,000	1,500,000	NONE	3,000,000	840,000	25,000,000	415	40	100	275	5,000	INDIANA
IOWA	34,432,000	17,432,000	13,787,000	12,287,000	1,500,000	-	3,000,000	645,000	17,000,000	1,090	308	519	263	6,674	IOWA
KANSAS	33,031,000	21,031,000	18,396,000	15,842,000	2,554,000	NONE	2,500,000	135,000	12,000,000	1,598	836	522	240	8,590	KANSAS
KENTUCKY	19,500,000	13,500,000	10,000,000	10,000,000	(5) -	-	3,000,000	500,000	6,000,000	900	400	330	170	3,200	KENTUCKY
LOUISIANA	19,000,000	11,500,000	8,500,000	6,500,000	2,000,000	-	3,000,000	-	7,500,000	500	-	450	50	4,750	LOUISIANA
MAINE	15,151,300	11,251,300	8,751,300	6,720,560	(5) 3,040,740	-	1,936,000	(7) 564,000	3,900,000	414	-	359	55	6,000	MAINE
MARYLAND	10,400,000	7,500,000	3,500,000	3,000,000	500,000	-	4,000,000	-	2,900,000	124	-	35	89	2,500	MARYLAND
MASSACHUSETTS	30,358,000	16,358,000	7,750,000	7,500,000	250,000	5,500,000	3,000,000	108,000	14,000,000	240	-	50	190	(8) 1,565	MASSACHUSETTS
MICHIGAN	52,750,000	20,750,000	16,600,000	15,000,000	1,600,000	NONE	4,150,000	-	32,000,000	415	50	165	200	7,300	MICHIGAN
MINNESOTA	31,700,000	14,500,000	8,525,000	7,860,000	665,000	-	4,500,000	(9) 1,475,000	17,200,000	1,007	490	390	127	(10) 6,956	MINNESOTA
MISSISSIPPI	9,630,000	4,630,000	2,780,000	2,780,000	(5) -	50,000	1,700,000	100,000	5,000,000	524	231	238	55	4,000	MISSISSIPPI
MISSOURI	28,893,825	18,893,825	14,543,825	13,043,825	1,500,000	-	3,000,000	(11)1,350,000	10,000,000	922	450	350	122	7,640	MISSOURI
MONTANA	8,655,000	3,655,000	3,140,000	2,890,000	250,000	100,000	375,000	100,000	5,000,000	261	-	259	1	1,100	MONTANA
NEBRASKA	17,100,000	7,100,000	4,600,000	4,000,000	600,000	250,000	2,000,000	(12) 250,000	10,000,000	1,310	600	700	10	6,000	NEBRASKA
NEVADA	2,160,530	1,860,530	1,300,185	1,330,186	60,000	71,000	279,000	120,345	500,000	149	-	145	4	1,502	NEVADA
NEW HAMPSHIRE	5,520,000	4,020,000	1,400,000	1,300,000	100,000	900,000	1,800,000	120,000	1,500,000	100	10	75	15	2,000	NEW HAMPSHIRE
NEW JERSEY	35,400,000	19,400,000	14,600,000	11,600,000	3,000,000	-	2,000,000	(13)2,800,000	16,000,000	120	10	-	110	3,890	NEW JERSEY
NEW MEXICO	3,882,000	3,582,000	2,410,000	1,900,000	510,000	125,000	838,000	209,000	300,000	179	45	125	9	4,860	NEW MEXICO
NEW YORK	85,400,000	51,400,000	54,000,000	51,000,000	3,000,000	-	7,400,000	-	24,000,000	1,006	-	-	1,006	9,781	NEW YORK
NORTH CAROLINA	(14) 25,000,000	15,000,000	11,000,000	11,000,000	(5) -	-	4,000,000	-	10,000,000	650	-	500	150	6,400	NORTH CAROLINA
NORTH DAKOTA	4,490,000	1,900,000	1,080,000	880,000	100,000	60,000	590,000	190,000	2,590,000	1,042	521	521	-	2,746	NORTH DAKOTA
OHIO	53,000,000	28,000,000	13,000,000	12,000,000	1,000,000	4,000,000	8,000,000	-	28,000,000	850	50	500	300	9,900	OHIO
OKLAHOMA	26,250,000	11,250,000	8,650,000	6,900,000	1,750,000	NONE	2,000,000	600,000	15,000,000	850	300	400	150	5,500	OKLAHOMA
OREGON	15,000,000	6,750,000	3,600,000	3,000,000	600,000	400,000	2,400,000	350,000	8,250,000	252	125	125	2	3,000	OREGON
PENNSYLVANIA	(15) 84,350,000	67,850,000	49,000,000	48,000,000	1,000,000	5,000,000	12,500,000	(16)1,450,000	16,400,000	1,300	100	400	800	12,033	PENNSYLVANIA
RHODE ISLAND	7,475,000	3,150,000	3,650,000	2,500,000	(17) 3,150,000	-	825,000	175,000	825,000	44	-	-	44	450	RHODE ISLAND
SOUTH CAROLINA	23,525,000	12,925,000	10,250,000	9,250,000	1,000,000	475,000	2,200,000	-	11,000,000	500	-	350	250	5,250	SOUTH CAROLINA
SOUTH DAKOTA	10,456,650	3,956,650	2,344,500	2,100,000	244,500	460,350	836,800	315,000	6,500,000	450	-	450	-	4,769	SOUTH DAKOTA
TENNESSEE	37,000,000	20,000,000	16,000,000	10,150,000	5,850,000	-	4,000,000	-	17,000,000	529	223	113	193	5,000	TENNESSEE
TEXAS	31,000,000	22,000,000	13,350,000	11,350,000	2,000,000	1,000,000	7,000,000	650,000	9,000,000	1,800	600	1,000	200	19,000	TEXAS
UTAH	3,770,000	2,540,000	1,800,000	1,600,000	200,000	140,000	600,000	-	1,230,000	100	-	93	7	3,300	UTAH
VERMONT	4,275,000	3,350,000	2,845,000	1,420,000	225,000	-	2,455,000	250,000	925,000	170	-	130	40	4,400	VERMONT
VIRGINIA	21,099,950	13,089,950	9,200,000	9,200,000	(5) -	-	3,266,730	623,220	8,000,000	381	119	65	196	5,207	VIRGINIA
WASHINGTON	18,620,000	9,250,000	7,250,000	6,250,000	1,000,000	550,000	1,250,000	100,000	9,370,000	385	170	165	50	3,200	WASHINGTON
WEST VIRGINIA	(14) 17,300,000	11,300,000	9,500,000	9,000,000	500,000	-	1,800,000	-	6,000,000	425	200	150	75	2,200	WEST VIRGINIA
WISCONSIN	24,772,000	21,462,000	17,262,000	15,262,000	2,000,000	1,200,000	3,000,000	-	3,310,000	1,559	-	1,195	374	(18) 10,000	WISCONSIN
WYOMING	4,214,000	3,215,000	2,180,000	1,700,000	480,000	109,000	666,000	260,000	999,000	350	150	200	-	2,925	WYOMING
TOTALS	1,136,257,055	668,958,055	482,201,130	426,504,090	56,697,040	30,140,850	127,404,710	19,211,666	477,299,000	27,167	7,026	12,443	7,688	243,189	TOTALS

REMARKS: THE ABOVE DATA IS REPORTED BY THE STATE HIGHWAY DEPARTMENTS OF THE RESPECTIVE STATES WITH BUT FEW EXCEPTIONS AS NOTED. THE FIGURES WHICH ARE CONSERVATIVE ESTIMATES AS A RULE, REPRESENT PRELIMINARY BUDGETS, EXCEPT THAT ROAD BOND PAYMENTS WHICH AMOUNT TO OVER $100,000,000 ARE EXCLUDED.
(1) SOME STATES INCLUDE RECONSTRUCTION OF ROAD COSTS IN MAINTENANCE EXPENSES AND WHEN SO REPORTED ARE SHOWN HERE SEPARATELY. IN OTHER STATES RECONSTRUCTION IS INCLUDED WITH CONSTRUCTION, THE ALLOCATION DEPENDING UPON THE POLICY OF THE STATE IN REGARD TO ROAD CONSTRUCTION. (2) WHERE NO ENTRY IS SHOWN, OVERHEAD IS INCLUDED IN CONSTRUCTION AND MAINTENANCE. IF LARGE MISCELLANEOUS EXPENSES ARE REPORTED SAME ARE NOTED. (3) INCLUDES 300 MILES OF ROAD OILING, $360,000. (4) REPRESENTS ROAD BUILDING THROUGH CITIES AND REFUNDS; OVERHEAD INCLUDED IN CONSTRUCTION AND MAINTENANCE. (5) INCLUDED IN ROAD CONSTRUCTION. (6) INCLUDES KENNEBEC BRIDGE, $2,090,740 (7) INCLUDES $464,000 FOR OTHER THAN OVERHEAD (8) STATE HIGHWAY MILEAGE THOROUGHLY MAINTAINED: EXCLUDES 6,000 MILES OF TOWN ROADS PARTLY MAINTAINED.
(9) INCLUDES $500,000 FOR PURCHASE OF RIGHT OF WAY. (10) EXCLUDES LOCAL ROAD MILEAGE FORMERLY REPORTED MAINTAINED BY STATE HIGHWAY DEPARTMENT. (11) INCLUDES $650,000 FOR MISCELLANEOUS EXPENSES.
(12) MISCELLANEOUS ONLY (13) INCLUDES $1,500,000 FOR PURCHASE OF RIGHT OF WAY. (14) ESTIMATE (BASED ON PREVIOUS YEAR'S DATA) MADE BY BUREAU OF PUBLIC ROADS (15) PARTIAL ESTIMATE BY BUREAU OF PUBLIC ROADS. (16) EXCLUDES $2,300,000 EXPENSES FOR HIGHWAY PATROL AND MOTOR VEHICLE REGISTRATION BUREAU. (17) INCLUDES $3,000,000 BOND ISSUE FOR WASHINGTON BRIDGE AT PROVIDENCE (18) IN ADDITION STATE MAINTAINS 12,200 MILES OF LOCAL SYSTEM. (19) ALL STATE HIGHWAY EXPENDITURES AND MILEAGE DATA ESTIMATED BY STATE HIGHWAY COMMISSIONER.

(Not for release)

ANTIVENIN ADVOCATED AS A NORTH AMERICAN SNAKE-BITE SERUM

According to a circular recently received from the H. K. Mulford Company of Philadelphia, that company is prepared to furnish a serum, known as Antivenin, which is efficacious in treating the bites of North American venomous snakes.

The serum is distributed in 10-cubic-centimeter syringes, which are sterilized and ready for immediate use. Where medical aid is not available, it may be self-administered by injection made under the skin of the thigh or, preferably, of the side of the abdomen.

The syringe contains enough Antivenin to protect against the average amount of venom secreted at one time by North American serpents. Where there is reason to believe that the poison injected by the serpent was of unusually large quantity, or when the symptoms develop quickly and in severe form as, for instance, in children, it is advisable to give a second dose within a few hours if the first has not given the desired relief. In any case, the entire contents of the syringe should be injected at one dose, whether the patient is an adult or a child.

The Mulford Company's circular advocates the application of a ligature or tourniquet immediately above the wound, if the bite has been inflicted on a limb. It stated that there is no particular advantage in making an incision, or in applying permanganate of potash solution or crystals, or any other chemical agents commonly recommended for the purpose; that, in order to have an effect on venom, potassium permanganate solution must be used in concentrations that are injurious to the tissues.

Above everything else, the company advocates that the use of alcohol, or any stimulant, be avoided. These, by strengthening the circulation, tend to help the distribution of the venom throughout the body. Strychnine or caffeine, however, may be used if symptoms of weakness and giddiness develop.

After the preliminary ligature has been applied, the patient should proceed to the nearest place where Antivenin may be administered. There is often sufficient time to have the injection made by a doctor, since North American snake venoms are usually slow in acting. If the Antivenin can be obtained within 12 to 24 hours after the bite, the chances of its being effective are good. In the meantime, the tourniquet should be kept in place, but care should

be taken to release the pressure at intervals to prevent the setting in of gangrene. As soon, however, as the serum is injected the tourniquet should be released.

The list price of Antivenin is $7.50 a package, containing one syringe, and it is available through the branches and depots of the H. K. Mulford Company, and their principal distributors throughout the United States.

The Bureau has been advised by the Public Health Service that serum for the relief of snake bites is not distributed by that service, and there is apparently no other branch of the Government from which such a serum may be obtained. The head of the Hygienic Laboratory, Dr. McCoy, states that experimental treatments of rabbits and mice with Antivenin have indicated that this serum is efficacious in the treatment of animals. No experiments have been made upon human beings, but the head of the laboratory understands that physicians in Texas have used the Mulford serum with good effect. While Dr. McCoy does not wish to commit himself as to the efficacy of the serum for the treatment of human beings, he states that he would not hesitate to prescribe its use as it would probably do some good, and certainly could do no harm.

Before ordering the serum, it is suggested that district engineers consult local representatives of the Public Health Service, or local physicians designated for the treatment of injured Government employees. In case the serum is used, an immediate and complete report should be made to the headquarters office as to the effect of the treatment.

(Not for release)

NEW RESEARCH PROJECT APPROVED

Title: A Statistical Analysis of Highway-Railroad Grade Crossing Accidents, in 1926, as reported by the Steam Railroads to the Interstate Commerce Commission.

Approved: May 28, 1927.

Leaders: A. B. Fletcher and W. G. Eliot, 3d.

Object: 1. To determine the relative frequency of grade-crossing accidents in rural and urban areas. The data may be used later in an attempt to establish the correct ratios which grade crossing accidents in the rural areas bear to the total of all the highway accidents in those areas.

2. To discover any other significant evidence as to causes and conditions of accidents which may be revealed in a mass analysis of the 5,890 accidents reported in 1926.

Procedure: The Bureau of Statistics of the Interstate Commerce Commission has on file a complete set of individual accident reports from all railroads under its jurisdiction. For those involving highway-railroad grade crossings the pertinent data will be transcribed and analyzed by means of tabulating machines.

Cooperation: None

Location: Washington, D. C.

Legal Authority: Bureau of Public Roads Appropriation Acts, 1927 and 1928.

Proposed Expenditure: About $1,000 (Salaries only of Mr. Eliot and two assistants. No travel required. This estimate includes no stationery or typewriting expense, nor tabulating machine cards, nor operating costs).

History: While the Interstate Commerce Commission has for some years published an analysis of grade-crossing accidents with respect to casualties and to details of railroad operation, there has been no complete analysis of these reports from the point of view of highway construction and traffic regulation.

(Not for release)

JOHN MILTON GOODELL

John Milton Goodell, consulting engineer to the Bureau during the years 1918-1920, died, on June 21, at the French Hospital in New York City.

Mr. Goodell, who had been editor of the Engineering Record, from 1903 to 1912, retired from active business in the latter year. Subsequently, he spent much of his time in writing books and technical articles on sewage, water supply, and roads. He was the author of "Location Construction and Maintenance of Roads."

At the outbreak of the World War he served for a time with the Committee on Public Information, later being employed as acting chairman of the U. S. Highways Council, a body created to control the distribution of materials, transportation, and labor for road work.

As a consulting engineer for the Bureau, Mr. Goodell was closely associated with Mr. Logan Waller Page, then director of the Office of Public Roads and Rural Engineering. He was also a warm, personal friend of Mr. MacDonald.

One of Mr. Goodell's outstanding accomplishments, as consultant to the Bureau, was his work in connection with the organization of the American Association of State Highway Officials.

Mr. Goodell was born at Worcester, Mass., on August 3, 1867. He was graduated from the Worcester Polytechnic Institute, with the degree of B.S. in C.E., in 1888, and later spent the winter of 1888-89, in post-graduate studies, at the Zurich Polytechnic Institute in Switzerland.

He was affiliated with the American Society of Civil Engineers, and a member of the American Society of Mechanical Engineers, the American Water Works Association, the Boston Society of Civil Engineers, and the New England Water Works Association.